

What makes an indicator actionable?

Bernard D. Goldstein

Dept. Environmental and Occupational Health

Graduate School of Public Health

University of Pittsburgh

bdgold@pitt.edu

GOALS



1. Build a sustainable National Environmental Public Health Tracking Network
2. Enhance Environmental Public Health Tracking Workforce and Infrastructure
3. Disseminate Information to Guide Policy, Practice, and Other Actions to Improve the Nation's Health
4. Advance Environmental Public Health Science and Research
5. Foster Collaboration Among Health and Environmental Programs

What makes an indicator actionable?

- Scientific validity
- Measurement validity
- Probability of response

Benjamin Franklin's Actionable
Indicator of How to Decrease the
Mortality of a Yellow Fever
Epidemic

Benjamin Franklin's Actionable Indicator of How to Decrease the Mortality of a Yellow Fever Epidemic

- Based on reports from a Yellow Fever epidemic in the Barbadoes, Franklin noted that the death rate declined dramatically when the doctors ran out of medicine.

Dancing with proper limitations is a salutary exercise, but when violent and long continued in a crowded room, it is extremely pernicious, and has hurried many young people to the grave.

A. Murray, M.D.
1828

Fun with Numbers: Efficiency Indicator for Complex Clinical Research

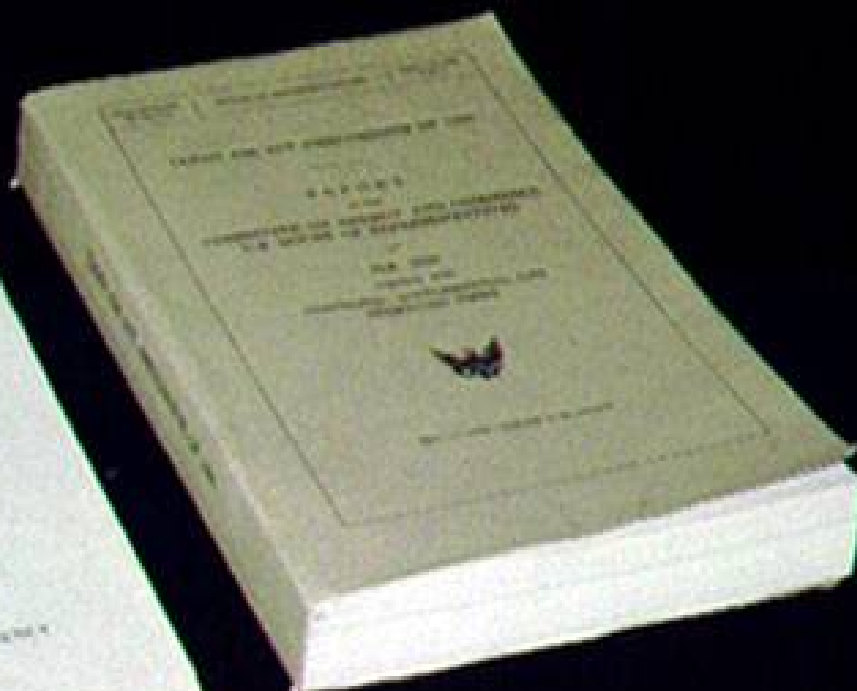
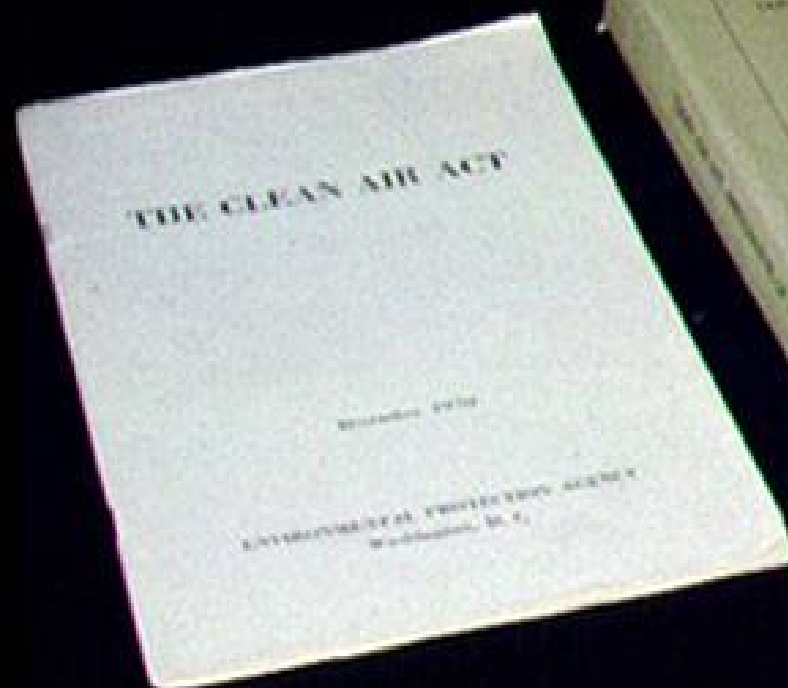
Fun with Numbers: Efficiency Indicator for Complex Clinical Research

Indicator: The ratio of the number of patients who are subjects, divided by the number of scientists who are coauthors of the published paper.

Any ratio above one is considered efficient

Searching for keys under the lamp post

- If blood lipids were more readily measurable than blood glucose - would diabetes be considered primarily a lipid disease rather than a carbohydrate disease?
- How would this affect actions taken to control diabetes?



Examples of NAAQS Standards for
which the wrong measurement parameters
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- Particulates: TSP to PM_{10} to $PM_{2.5}$

Examples of NAAQS Standards for which the wrong measurement parameters impaired the effectiveness of the action

- Particulates: TSP to PM_{10} to $PM_{2.5}$
- Ozone: 1 hr to 8 hr averaging time

Measurability vs Actionability

- If actionability is based on temporal or geographic factors, then measurement should also be based on these temporal or geographic factors

Ambient vs Internal Measures of Carbon Monoxide: Measurement Validity

- Ambient measurement: appropriate placement of ambient monitor is challenging due to wide variation in CO levels in those outdoor micro-zones which are targeted for public health protection under Clean Air Act
- Internal measurement: high measurement validity as an integrated measure of personal CO exposure over 8-12 hours, and high scientific validity as an indicator of exposure and a predictor of effect

Ambient vs Internal Measures of Carbon Monoxide: Actionability

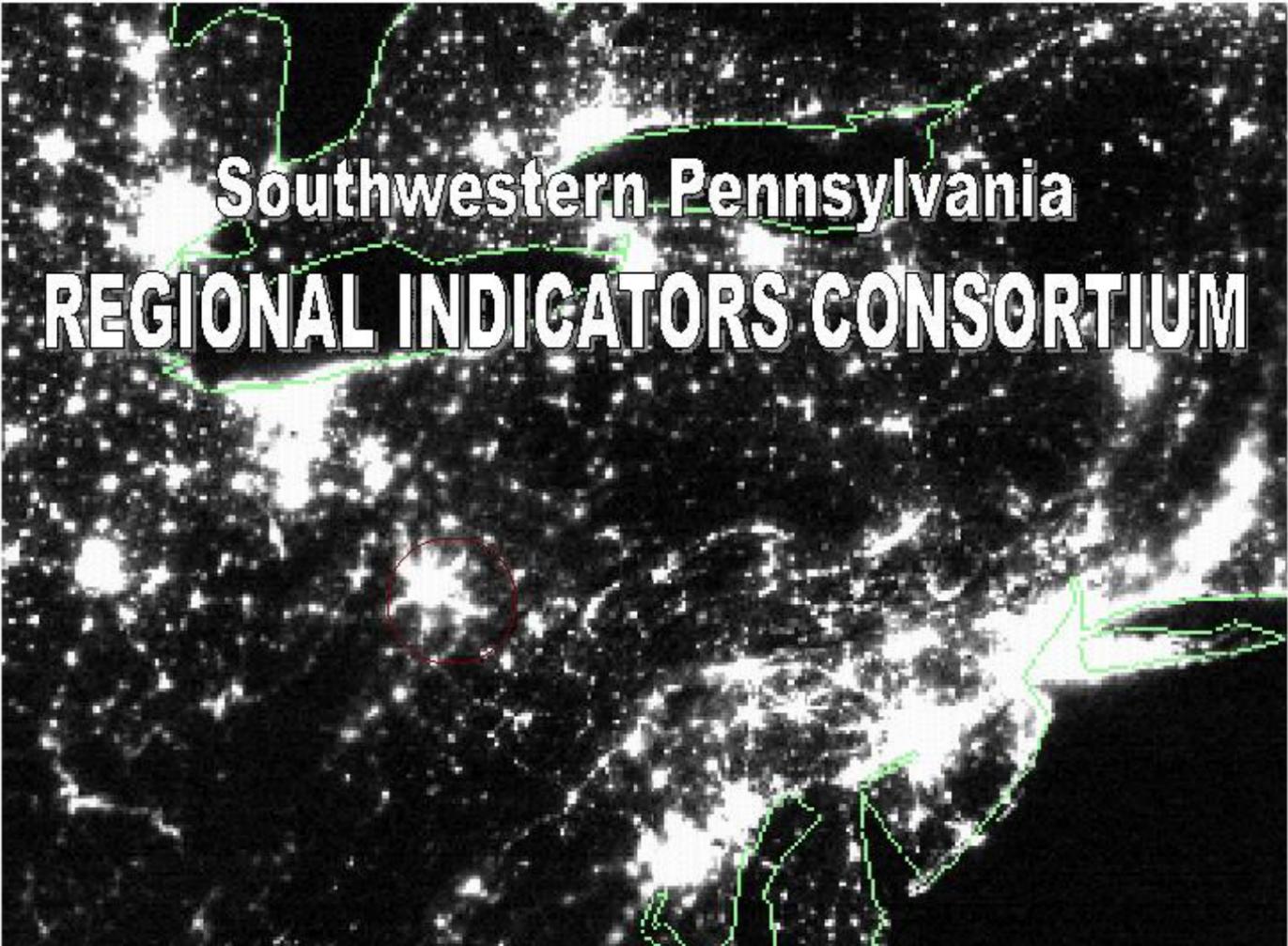
- Ambient measurement: directly related to sources controllable under Clean Air Act
- Internal measurement: highly confounded in relation to outdoor automotive sources by exposure to cigarette smoke and by production of CO in normal metabolism

The Role of Predictability in Actionability: Hantavirus in Southwest

- El Nino – Southern Oscillation
- Unusual heavy rains in spring in Southwest
- Increase in rodent food (grasshoppers, pinion nuts)
- Increase in rodent population (and snakes)
- Increased human contact with rodents and their detritus (also sprawl, ecotourism)
- Higher incidence of human Hantavirus infections
- Increased mortality from Hantavirus infections

Achieving Actionability

- Probability of response
 - Technical feasibility
 - Legal
 - Economic
 - Social
 - Political
 - Communicability (“Attracting attention with data”)

A satellite image of Pennsylvania with a green outline of the state. A red circle is drawn in the southwestern part of the state, highlighting a specific region. The text "Southwestern Pennsylvania REGIONAL INDICATORS CONSORTIUM" is overlaid on the image.

Southwestern Pennsylvania
REGIONAL INDICATORS CONSORTIUM

► Introduction

► Prototype

► Topic Areas

- Demographics
- Health
- Transportation
- Economy

► Other Topics

► Summary

What is a good indicator?

- Easy to understand
- Useful
- Obtainable at a reasonable cost
- Actionable

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Presentation Counts

- Timely
- Cumulative
- Context

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Recommended Nursing Home Indicators

- Percent of residents who were physically restrained
- Percent of high risk residents who have pressure sores
- Percent of low risk residents who have pressure sores
 - HP2010 Target is 8 diagnoses per 1,000 residents

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► Prototype

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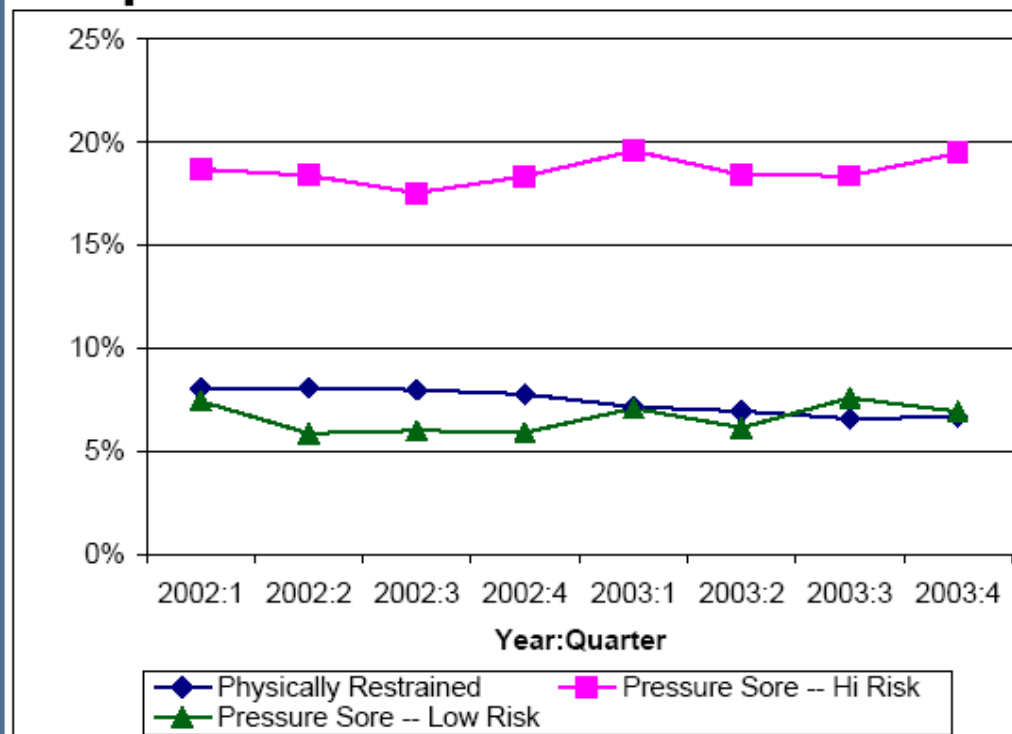
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Nursing Home Indicators for Pittsburgh Have Not Shown Improvement over Two Years



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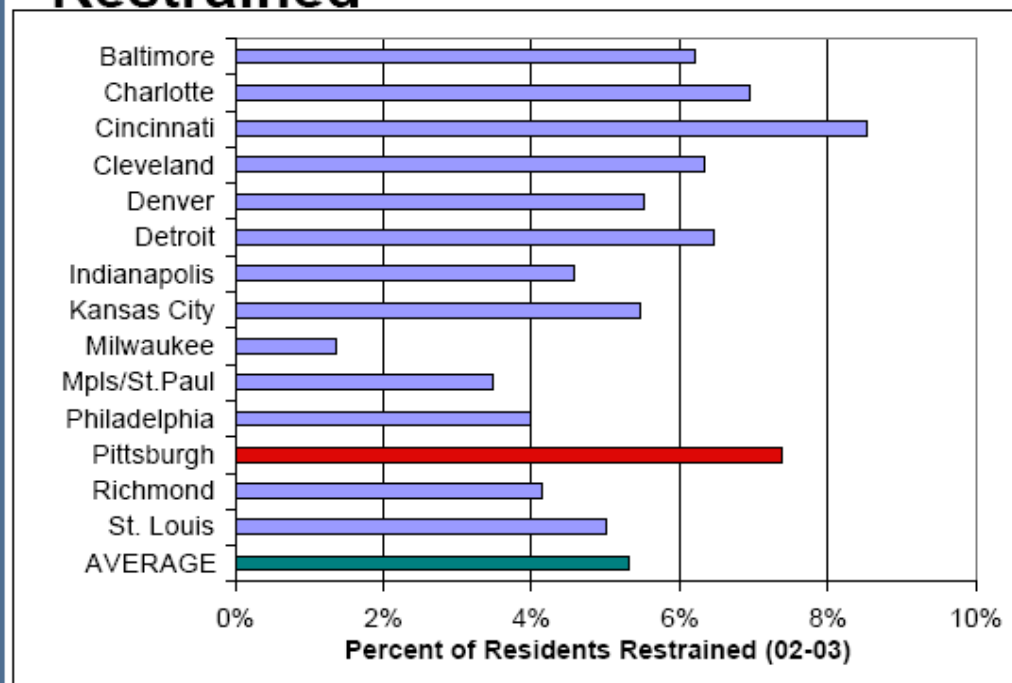
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Pittsburgh Nursing Home Patients Are More Likely To Be Restrained



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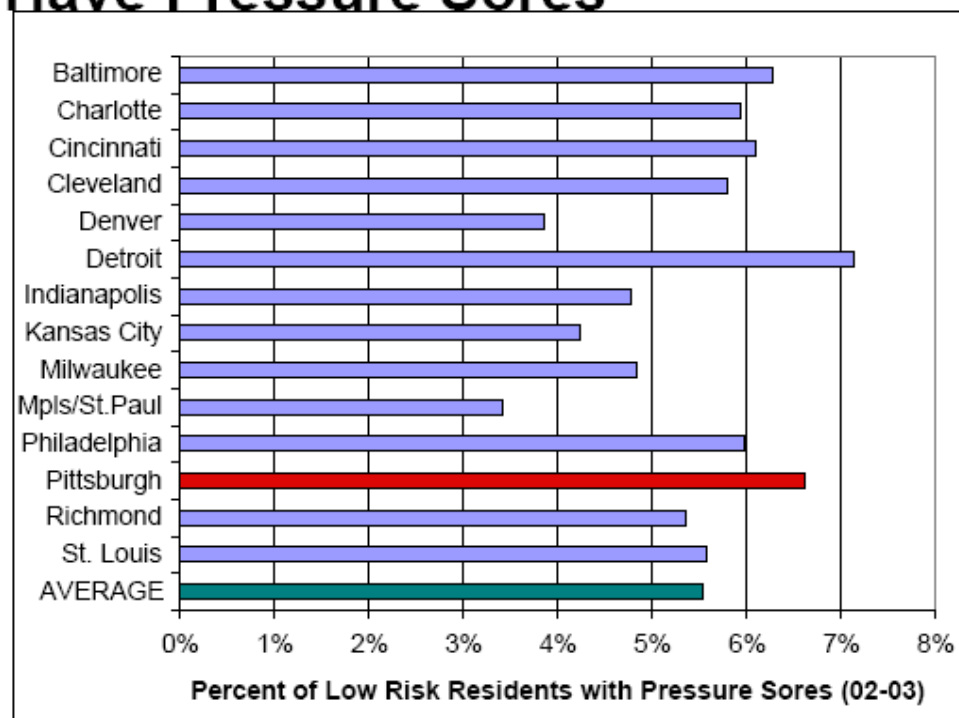
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Pittsburgh Nursing Home Residents Are More Likely To Have Pressure Sores



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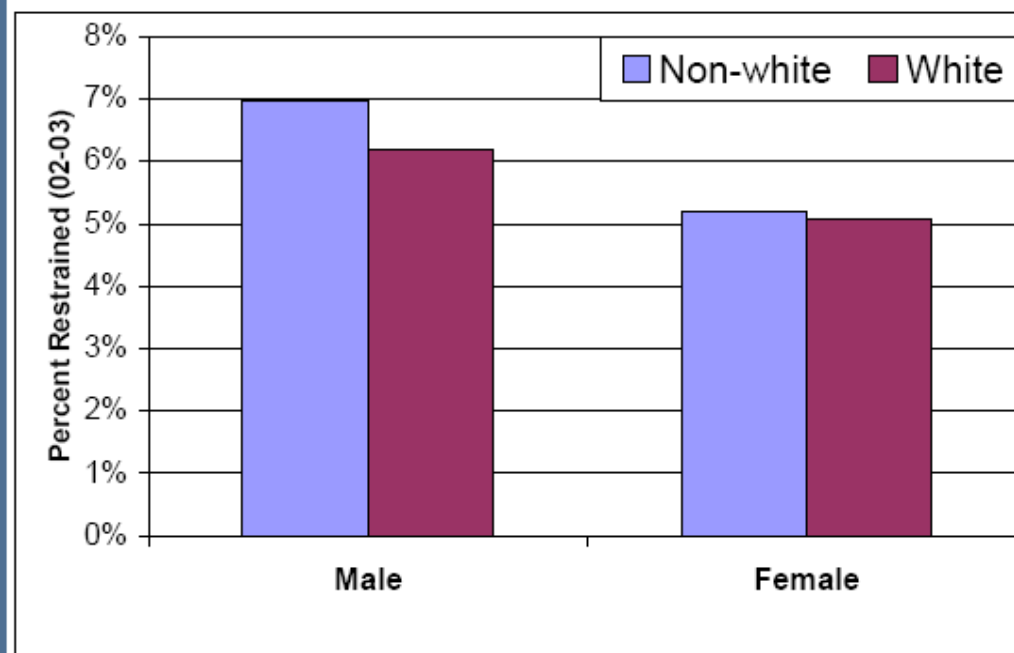
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Non-white Males Are More Likely To Be Restrained in Nursing Homes in Pittsburgh

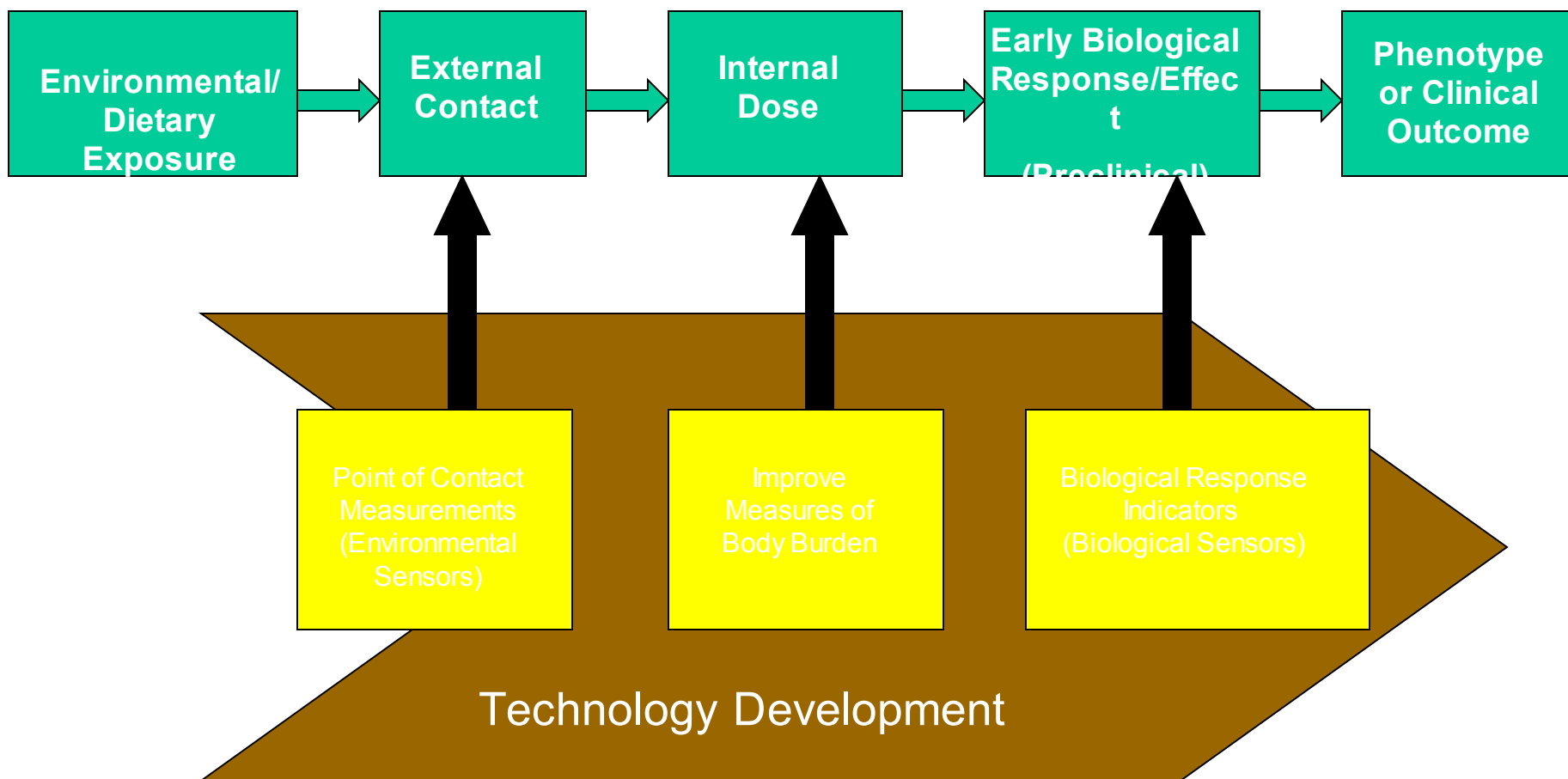


National Environmental Public Health Tracking Program – Network Implementation RFA

David J. Marchetto, M.S., C.P.H.
District Epidemiology Manager
PA Department of Health

Core Data Measures

- Asthma Hospitalizations
- Myocardial Infarction Hospitalizations
- Ozone and Particulate Matter Hazards or Exposures
- Water Contaminants
- Birth Defects, Cancer, Child Blood Lead Levels, Vital Statistics



ROLE OF BIOMARKERS

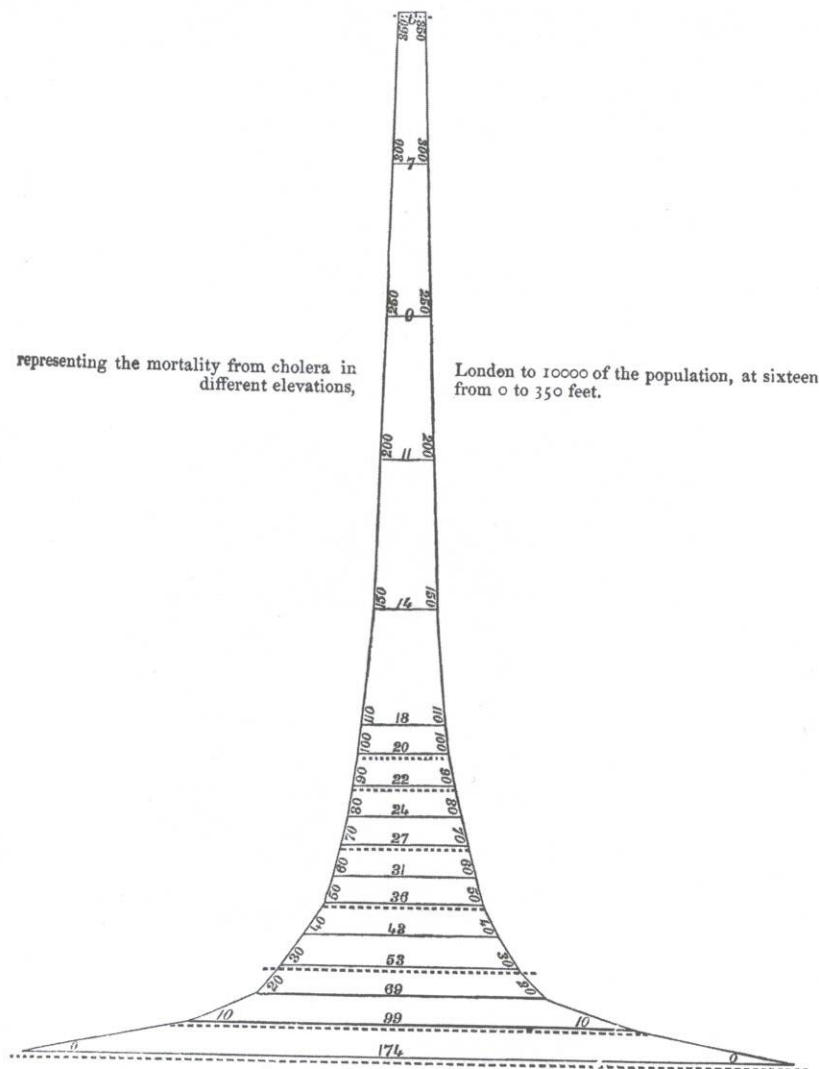
LEAD VS ASBESTOS

- Lead
 - IQ and blood pressure measurable in all
 - Blood lead levels measurable in all
- Asbestos
 - Pulmonary function measurable in all
 - Lung asbestos levels measurable only at high doses as pulmonary fibrosis

John Ben Snow

1813-1858

- Considered as founder of epidemiology
 - Used careful statistical analysis and an intervention to determine that cholera was a waterborne disease
 - Ended London cholera epidemic by causing removal of handle from Broad Street pump
 - *Discovery antedated germ theory of disease*



The figures in the centre express the number of deaths from cholera to 10000 inhabitants living at the elevations expressed in feet on the sides of the diagram.

The length of the black horizontal lines shows the calculated relative fatality of cholera in districts at relative elevations indicated by the height from the base of the diagram. The dotted lines indicate the mean mortality observed in the elevations given. Thus:—in districts at 90 feet above the Thames, the average mortality from cholera was 22 in 10000 inhabitants.

Figure 7.7. Farr's graph of cholera incidence related to elevation
 ([Farr], *Cholera in England, 1848-1849*, lxxv).

Vinten-Johansen P, et al.
*Cholera, Chloroform, and the
 Science of Medicine: A Life of
 John Snow*. New York: Oxford
 University Press. 2003.

Milestones in the History of Anesthesia

- 1846: First use of ether for anesthesia by William Morton at Harvard
- 1846: First use of ether for anesthesia in England

Milestones in the History of Anesthesia

- Public reluctance overcome when Queen Victoria in 1853 gave birth to her eighth child while undergoing chloroform anesthesia

Milestones in the History of Anesthesia

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JOHN SNOW WAS
THE ANESTHESIOLOGIST

Snow's early experiments with chloroform

Degree of narcotism	Quantity of chloroform/air	Chloroform/blood concentration
2 nd	1 grain *64.8 mg)/100 cubic inches air	1/16,285
3 rd	1.5 grains (97.2 mg)/100 cubic inches air	1/10,857
4 th	2 grains (129.6 mg)/100 cubic inches air	1/28
5 th	2.5 grains (162 mg)/100 cubic inches air	1/22

Vinten-Johansen P, et al. *Cholera, Chloroform, and the Science of Medicine: A Life of John Snow*. New York: Oxford University Press. 2003.

John Snow

Pulmonary Toxicologist

- Animal studies of respiratory mechanics and gas exchange
- Cholera could not be due to inhalation

The Broad Street Pump as a Model for a Successful Public Health Impact (Model One)

1.	Gather data about a public health problem <i>without the need for scientific understanding of causal relationships.</i>
2.	Intervene based on this data.
3.	Determine if the intervention is associated with success.
4.	Replicate the intervention elsewhere and by others.

The Broad Street Pump as a Model of a Successful Public Health Impact (Model Two)

1.	Gather data about a public health problem <i>in the context of understanding the basic science.</i>
2.	Intervene based on this data.
3.	Determine if the intervention is associated with success.
4.	Replicate the intervention elsewhere and by others.

**Science consists of going up
alleys to see if they are
blind**

Measurable vs Meaningful vs Actionable

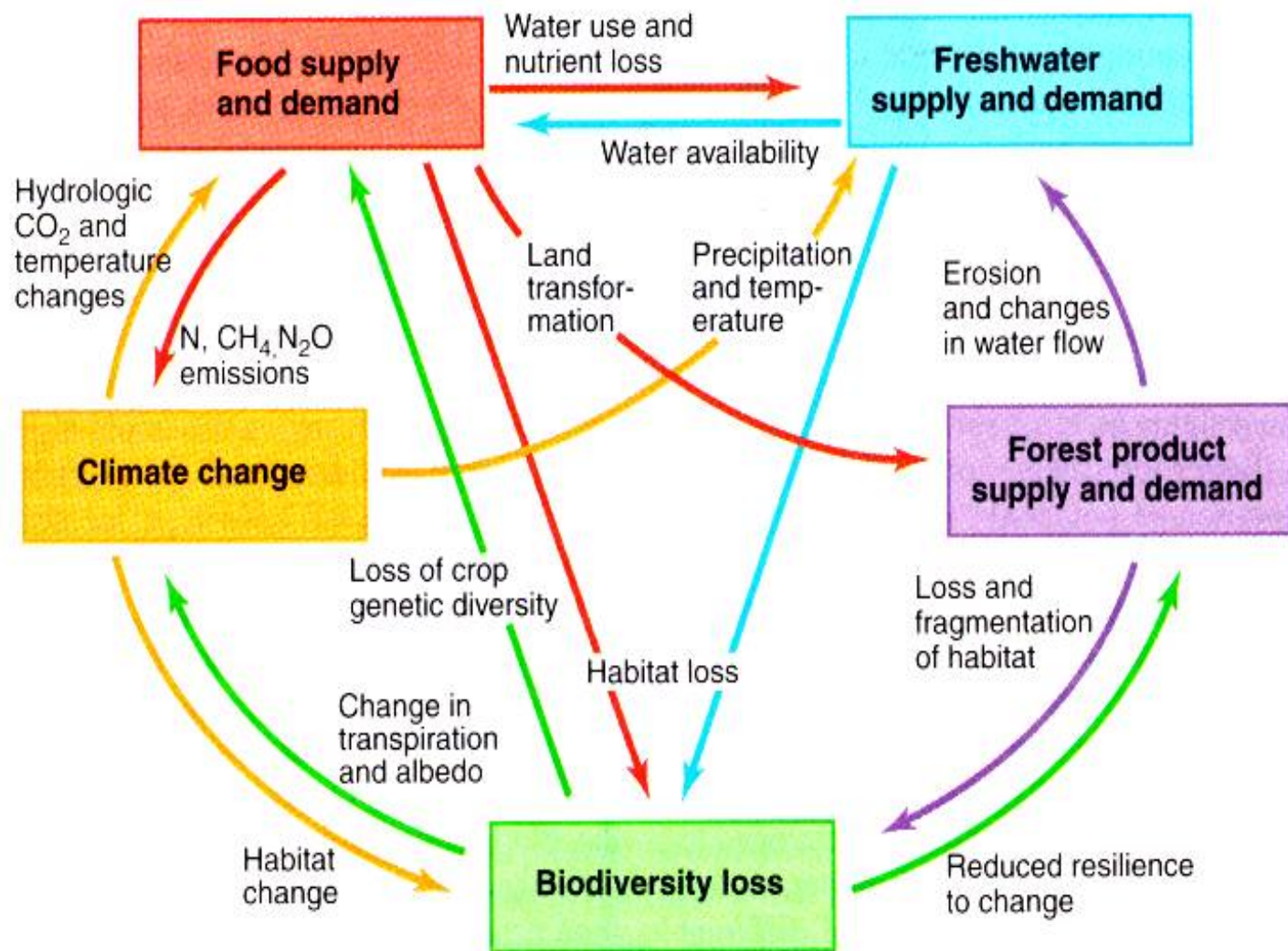
- Measurable does not necessarily equal meaningful
- Meaningful does not necessarily equal actionable
- The first step in Quality Assurance of a measurement is to establish the Data Quality Objective (DQO)
- For an actionable indicator, the DQO must be based on the quality of the data that will be useful or necessary for effective decision making

Rationale for Environmental Indicator Sample Bank

**THE ONLY CERTAIN PREDICTION
FOR THE NEXT DECADE IS THAT
THERE WILL BE AT LEAST ONE
MAJOR ENVIRONMENTAL
PROBLEM THAT NO ONE NOW
PREDICTS.**

When I grow up, I want to be a
business mogul, live in a villa in the
suburbs, wear a suit by Pierre
Cardin, and drive a Mercedes-Benz
600 to work in Beijing.

Chinese 5th Grader,
quoted in *World Press Review*,
November, 1997



Political determinants of actionability

- Term of office
- Whose idea is it, or was it?
- Economic Implications
- Count the votes
 - electorate
 - peers
- Media power
 - Does it fit media needs?
 - Is there a “bad guy”?

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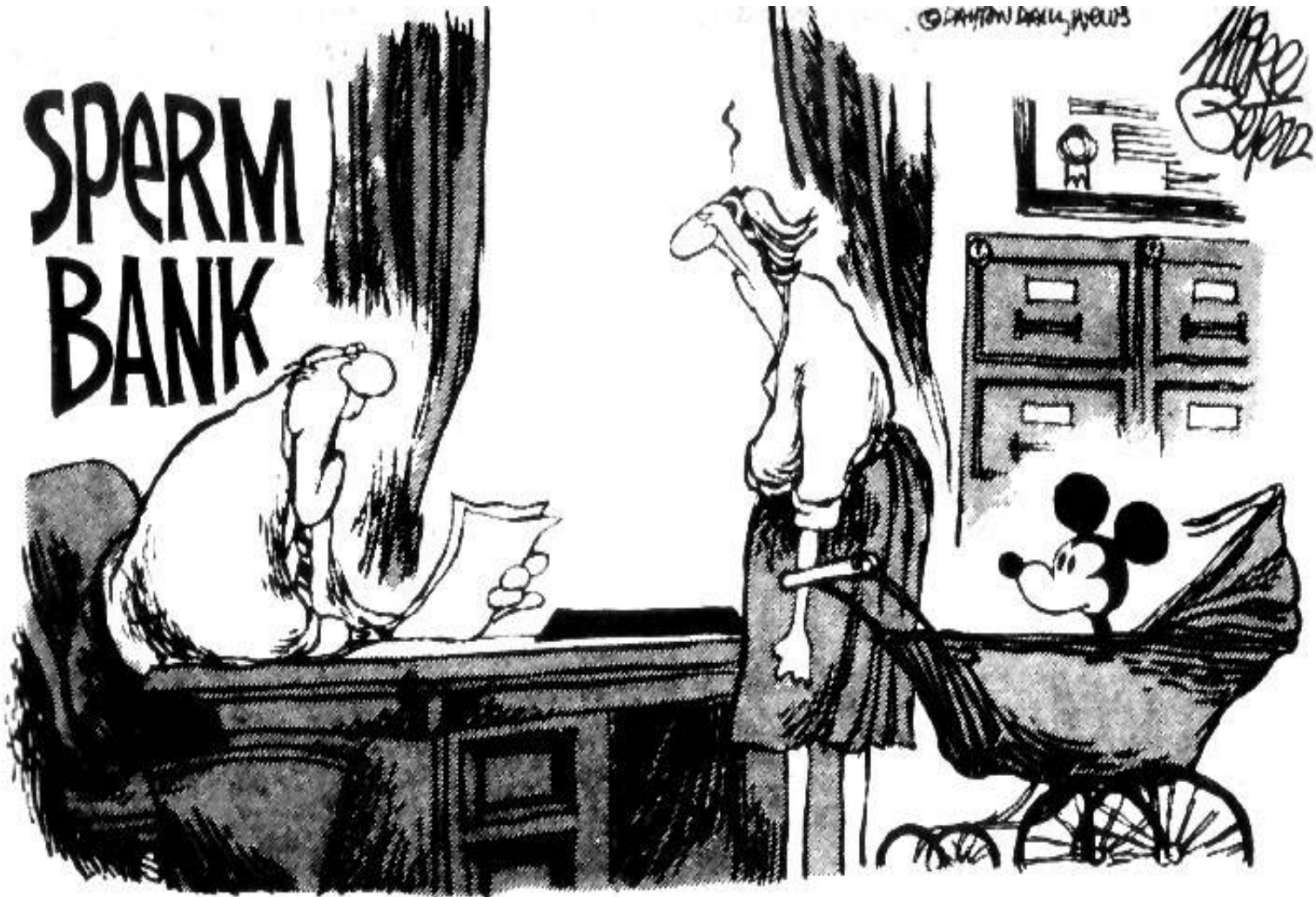
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SPERM BANK



LOOK, LADY— YOU'RE THE ONE WHO ASKED FOR A FAMOUS MOVIE STAR
WITH DARK HAIR, STRONG NOSE AND DEEP SET EYES...

FIGHTS THE SUN. NOT YOUR SKIN.

- Sun protection without chemical sunscreens - without skin irritation

- Creates a transparent physical block that deflects the sun's rays

- Safe enough for the most sensitive skin - even children's

- Full UV protection against the sun's burning UVB rays and aging UVA rays. SPF 17



Farmed Salmon Have More Contaminants Than Wild Ones, Study Finds

By GINA KOLATA

A new study of fillets from 700 salmon, wild and farmed, finds that farmed fish consistently have more PCB's and other contaminants, at levels far below the limits set by the federal government.

The study, the largest so far to look at contaminants in salmon, is being published today in the journal *Science*. It found more than a sevenfold difference in PCB levels, with farmed salmon having an average of 3 parts per billion and wild salmon having 4.75.

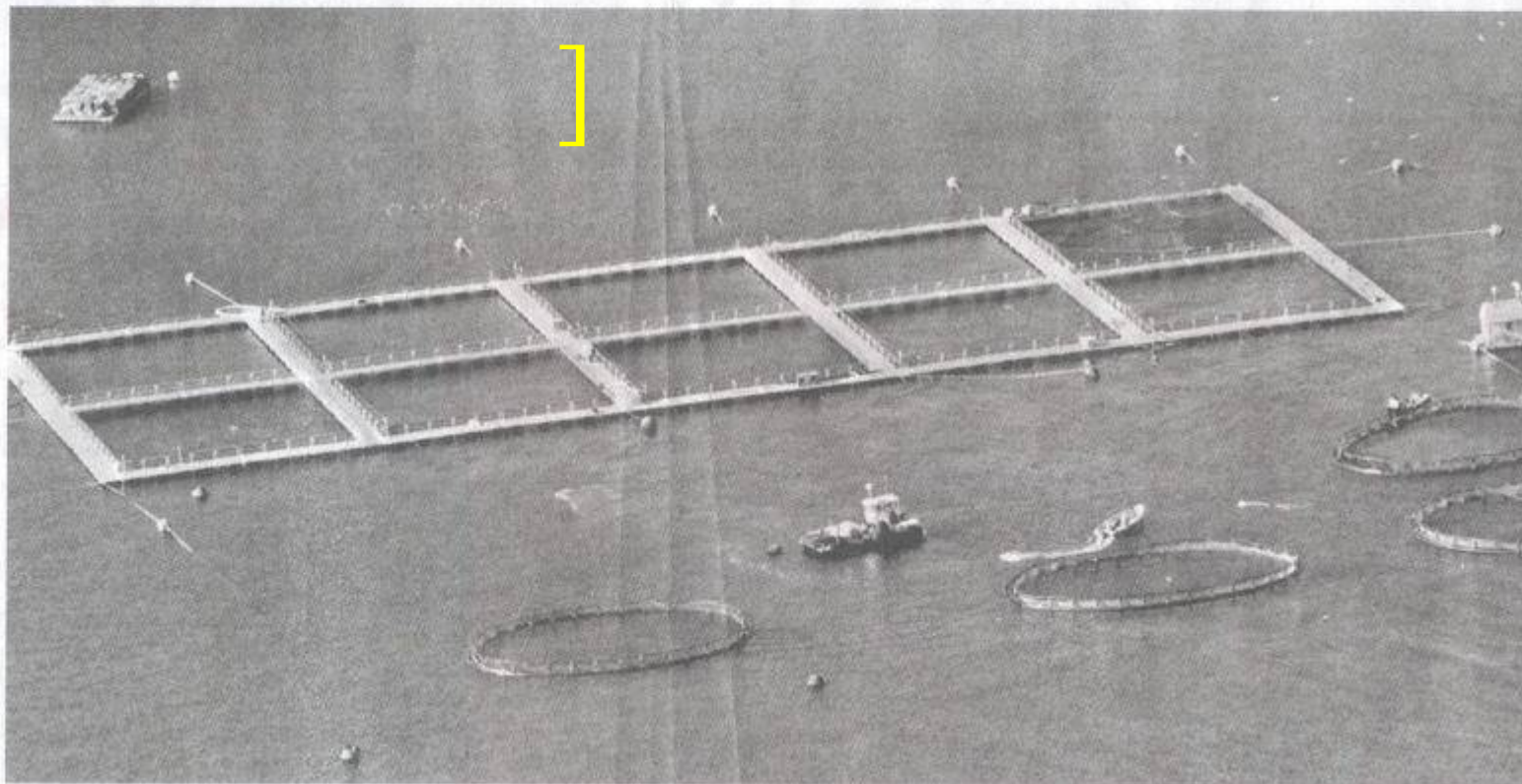
The authors advised people to limit their consumption of salmon. "Although the risk/benefit computation is complicated," they wrote, "consumption of farmed Atlantic salmon poses risks that detract from the beneficial effects of fish consumption."

Dr. Barbara Knuth, a study author and chairwoman of the department of natural resources at Cornell University, said, "It indicates that a vast majority of farm-raised Atlantic salmon should be consumed at a meal or less per month."

More than 90 percent of the fresh salmon eaten in this country is farmed, and sales have been growing 10 percent to 20 percent a year, says Alex Trent, executive director of the National Seafood Marketing Board of the Americas, an industry group.

Officials of the Food and Drug Administration disputed the study's recommendations.

"We certainly don't think there's a public health concern here," said Dr. John Troxell, director of the agency's office of plant and dairy foods and beverages. "Our advice to consumers is not to alter their consumption of farmed or wild salmon." The agency's tolerance level for



Farm-raised salmon, like those produced in these pens in Maine, account for more than 90 percent of sales in the United States.

the 1970's. The environmental agency says they are a probable carcinogen, though that has never been proved in humans. They were once used as coolants and lubricants and to make products like plastics and paints.

The other contaminants measured in the study include dioxins —

the industry was working on ways to reduce them, substituting soybean oil for part of the fish oil in feed.

"The fact is that PCB's don't belong in any food," Mr. Trent said, "and we are working very hard to get it out of our food." But, he quickly added, the contaminants are in meats and dairy products, too.

"If you put the same standards on milk," Mr. Trent said, "people would be allowed to drink five glasses of milk a week."

This study confirmed the findings

could cause cancer in laboratory rodents. In animals, some of the cancer-causing PCB's are blocked by others that do not cause cancer.

Other contaminants, like dioxins, can also block the effects of PCB's, said Dr. Stephen Safe, professor of toxicology at Texas A&M University. In addition, in laboratory tests, some PCB's can block dioxins and some chemicals in vegetables can block the cancer-causing effects of both PCB's and dioxins.

"No one is really sure how impor-

"We don't consider adding the risks together for compounds unless you have evidence to show they're acting through the same mechanism of action," he said. "We're not aware of any relating to that."

Dr. Knuth, the author of the study, acknowledged the government's dilemma over how to assess the risks. "I said the environmentalists allowed adding cancer risks, of course, is a value judgment which you think is appropriate."

A report says people should eat less farmed

